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ELECTRICITY  
AND  
GALVANISM  

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BY LAWRENCE

Medical Department

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ON THE

APPLICATION AND EFFECT

OF

ELECTRICITY AND GALVANISM

IN THE TREATMENT OF

CANCEROUS, NERVOUS, RHEUMATIC,

AND

OTHER AFFECTIONS.

BY

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LONDON:

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1853.

“ Quæ quidem studia quamvis non faciunt medicum aptiorem tamen  
medicinæ faciunt.”—CELSUS.

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## P R E F A C E.

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I HAVE been induced to publish this little work in consequence of it having been frequently observed to me with regret, that my former book treated only on the application of electro-magnetism to complaints of a rheumatic character. My own experience has convinced me that it is equally efficacious in the treatment of numerous other complaints, and I am therefore desirous of drawing the attention of the profession to an agent which has hitherto met with little consideration. With this object, I have

merely given a very brief account of the diseases in which it is available, and in which its curative powers have been tested, and should it be the means of leading to a more general use of this remedy, I shall consider that my time has not been uselessly employed.

21 Connaught Square,  
April 21st, 1853.



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# ELECTRICITY AND GALVANISM.

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## CHAPTER I.

THALES, who lived six centuries before the Christian era, was the first who observed the electrical properties of amber, and was so struck with its remarkable appearances as to suppose it to be animated. Theophrastus of Eresos, the most distinguished of the pupils of Aristotle, three hundred years afterwards discovered that tourmaline had the power of attracting light bodies ; and then these first gleams of knowledge seem to have been hid in the long obscurity of ages, until Dr. Gilbert, of Colchester, about two hundred years ago, published a work on Magnetism, wherein he mentioned several

new facts attributable to electrical agency, which again drew the attention of philosophers to this subject. It was not, however, until the year 1746 that, in consequence of some interesting experiments which led to the introduction of the Leyden jar, the surprising effects of frictional electricity on the human body became known. When first discovered, imagination placed no limit to its medical powers ; and with no fixed laws to regulate its application, and no perception of the difference of effect produced by currents flowing in contrary directions, it was indiscriminately applied in the treatment of the most opposite diseases ; and as a natural consequence of such empiricism, together with the expensive and cumbersome apparatus required for its excitation in a state of even moderate tension, it quickly fell into disrepute, and it was not until the commencement of the present century that the study of Electro-Physiology was resumed. We are greatly indebted to the laborious researches of Matteucci and other philosophers for the progress which has since been made in this science, and, as Mr. Noad observes, “ It is much to be desired that the knowledge

with which we have been furnished by the beautiful electro-physiological researches of Matteucci should receive a more extended practical application in this country than it hitherto has had."

The application and effects of electricity will be best explained and understood by my first giving a short description of the different methods of exciting it. Electricity is derived from five different sources, viz. :—From friction, called Frictional Electricity. From chemical action, called Galvanic or Voltaic Electricity. From certain arrangements with induced magnets, called Electro-Magnetic Electricity, or with permanent magnets, called Magneto-Electricity. From some peculiar power possessed by certain animals, as the torpedo and gymnotus, called Animal Electricity. From the disturbance of temperature, called Thermo-Electricity.

### FRICTIONAL ELECTRICITY.

The first form of apparatus employed in the application of frictional electricity was the common electrical machine and the Leyden jar. There are two kinds of electrical machines, the cylindrical

and the plate machine. The theory of the electrical machine is as follows:—By turning the handle of the cylinder the electricity in the rubber is decomposed, the positive adheres to the glass, the negative to the rubber, which would therefore, after a few revolutions, if insulated, develop no more free positive electricity ; to prevent which result a communication is made between the rubber and the earth, by which means the supply of positive electricity is kept up and the negative state neutralized : the positive electric portions of the glass coming during its revolution opposite to the points on the conductor, act powerfully by induction on the natural electricities of the conductor attracting the negative, which being accumulated in a state of tension at the points, darts off towards the cylinder to meet the positive fluid, and thus restores the neutral compound. The conductor is therefore left powerfully positive. The terms positive and negative are employed to distinguish two different forms of excitement ; and although they originated in theoretical views of the nature of electrical disturbance, which are not now recognised, they are on the whole less objectionable than



the other terms, and consequently their use has been retained. Positive electricity is produced upon polished glass when rubbed with a woollen cloth, and negative electricity is produced upon a stick of sealing-wax when rubbed. One kind of electricity cannot be produced without the other ; and of two substances which excite electricity by mutual friction, one is positive and the other negative.

The Leyden jar enables us to increase the intensity of the electric power, but is not applicable to medical purposes, because, by bringing large quantities of electric fluid of great intensity at once into action, it produces in the human body concussions of too violent and consequently injurious a nature.

Electric shocks may be rendered so powerful as to cause instant death ; and the same appearances are observed upon bodies after death so caused, as on the bodies of those killed by lightning : they undergo, in both cases, rapid putrefaction, and the blood does not coagulate.

## GALVANIC OR VOLTAIC ELECTRICITY.

Galvanic or voltaic electricity owes its origin to an accidental circumstance connected with some experiments on animal electricity, which were being carried on by Galvani, a Professor of Anatomy at Bologna, in 1791. The wife of Galvani, being consumptive, was advised to take, as a nutritive article of food, some soup made of the flesh of frogs. Several of these animals, recently killed and skinned, were lying on a table in the laboratory, close to an electrical machine, with which a pupil of the professor's was making experiments. While the machine was in action, he chanced to touch the bare nerve of the leg of one of the frogs with the blade of a knife which he held in his hand, when suddenly the whole limb was thrown into violent convulsions. Galvani, on being made acquainted with this phenomenon, discovered, after much investigation, that the effect was independent of the electrical machine, and might be equally well produced by making a metallic communication between the outside muscle and the crural nerve. It is, however, to Professor

Volta, of Pavia, we are indebted for the first voltaic pile, and the discovery of the electric excitement being the result of mutual contact of two dissimilar metals, by the meeting of which natural electricity was decomposed, the positive fluid passing to one metal, the negative to the other, and that the muscle of the frog was merely a conductor. The difference between common and voltaic electricity\* is as follows: the first produces its effects by a comparatively small quantity of electricity, insulated in a high state of tension, having remarkable attractive and repulsive energies, and power to force its way through obstructing media; the latter is more intimately associated with other bodies, enormous in quantity but rarely attaining a high state of tension, and exhibiting its effects while flowing in a continuous stream along conducting bodies. There are many modifications of the voltaic pile, as Groves's, Daniel's, and Smee's;

\* Experiments were made at the School of Medicine in Paris on the treatment of disease by galvanism, and the Commission which reported on it found reason to conclude that the effects of the voltaic battery penetrate and affect the nervous and muscular structures more deeply than ordinary electric machines.—*Becquerel*, vol. i.

the last, from its simplicity and the ease with which it is set in action, is in most general use.

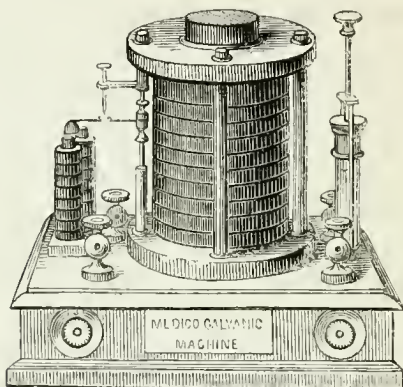
### ELECTRO-MAGNETISM.

In the year 1819, Professor Oersted observed, that when a magnetic needle was brought near the connecting medium, it was immediately deflected from its natural position, and took up a new one, depending on the relative positions of the needle and wire. This discovery led to the construction of new apparatus. The first magneto-electric machine—that is, an instrument by which a continuous and rapid succession of sparks could be obtained from a permanent magnet, was invented by M. Hipolyte Pixii, of Paris, and was first made public at the meeting of the Academie des Sciences, in September 1830: a description of it may be found in the *Annales de Chimie* for July 1832. With this machine, furnished with a coil about three thousand feet in length, sparks and strong shocks were obtained. Since this period, numerous forms of electro-magnetic machines have been invented for medical purposes, but most of them are wrong

in principle, being so constructed as to give shocks of great intensity, thereby causing much nervous irritation, and acting very prejudicially on the human body. In fact, these machines, as a short description will show, entirely fail in two essential requisites, viz., in producing quantity of electric fluid, and the power of passing the current in one direction. A coil of about thirty feet of thick insulated copper-wire is wound on a small bobbin, and over this a length of about fifteen hundred feet of thin insulated copper-wire; by sending the current from the battery through the interior coil, the electricity in the exterior coil is set in motion by its inductive influence; on breaking battery-contact, the current immediately ceases in the thick wire, and the electricity in the thin wire, freed from the disturbing cause, returns to its original condition, at the same time producing a shock. It will be evident that the current produced in the thin wire is not derived from the battery, and that it flows in one direction when contact is made, and in the opposite when contact is broken; a bundle of iron wires placed in the hollow axis of the bobbin, by becoming a series of

temporary magnets, increases the brilliancy of the sparks and the intensity of the shocks.

The instrument I employ, called by the inventors, the Electro-Galvanic Machine, differs from those of which I have spoken in deriving its electricity



from the battery, the current being sent through one coil of thick wire, in order to give it sufficient intensity to overcome the resistance which it experiences in passing through the body.

#### ANIMAL ELECTRICITY.

Certain fishes, as the gymnotus and the torpedo, possess the property of generating electricity, a

power which seems principally given to them as a means of defence, and can be exercised at will. It appears closely connected with nervous power,\* and great exhaustion follows its repeated exertion. The torpedo is met with in Europe; the gymnotus and others are confined to the tropics.

## THERMO-ELECTRICITY.

Thermo-Electricity, as made known by M. Seebeck, of Berlin, is that which can be excited in

\* Professor Matteucci, in his observations laid before the Royal Society, says: "We have every reason to conclude that the electric organ of the torpedo, and of all the electric fishes, is composed of a great number of elementary organs, and that the elementary organ is nothing else but a nervous fibril in contact with a small cell filled with albumen. It is in studying the production of electricity in the different electric fishes, together with the distribution of nervous filaments in their electric organs, that we arrive at a better understanding of this relation between nervous force and electricity. Thus we see in the torpedo and gymnotus, the two electric fishes best known, physically and anatomically, that the nervous filament always ramifies in the electric organs of these fishes perpendicularly to the axis of the prisms of these organs."

all metallic bodies by disturbing the equilibrium of temperature, the essential conditions being, that the extremities should be in opposite states as regards temperature. When two different metals, as copper and bismuth, are soldered together, an electric current becomes developed on heating the point of juncture of the two metals with a spirit-lamp.



## CHAPTER II.

## ELECTRO-PHYSIOLOGY.

BEFORE proceeding to enumerate the diseases in which electricity exercises a beneficial influence, its physiological effects upon the human body demand a brief consideration. The description I have given of the Electro-Magnetic coils in general use alone evidences how little attention has been paid to so important a subject. In fact, this agent has been employed in the treatment of disease merely with a vague notion of its power to remove the sufferings of the patient, and without a knowledge of those laws which guide its action, or any definite idea of the results to be expected from its application. No wonder that a remedy conducted in such blind ignorance of its operations should fail, and disappointment ensue to those who had resorted to it perhaps when all other means had

been tried in vain. Nor is it surprising that men of narrow minds, who look at results without examining the causes which lead to them, should condemn it at once, and cast ridicule on the efforts of those whose aim it is to enlarge the sphere of the medical art by applying the knowledge derived from the collateral sciences. It is thus that many have been deterred from the study of this wonderful and ever-present agent, and its application left in the hands of the empiric.

In 1791 Professor Galvani, in his famous commentary, published his experiments on the muscular contractions of frogs, and founded that science which bears his name. According to Galvani's theory, the muscles chiefly contain the animal electricity. They represent a Leyden jar, their outer surface being charged with negative, their inner with positive electricity. The nerve is the conductor of this jar, and together with the blood-vessels it supplies the muscles with electricity. The celebrated Volta, of Pavia, repeated Galvani's experiments, and came to the conclusion that the muscular contractions were produced by the irritation of the nerves, and that this irritation by the

metallic arc was caused by an electric current excited by that arc. In 1796 Volta made his immortal discovery of the pile which caused all opposition on the part of Galvani to fall into oblivion, and for twenty-three years no further mention of animal electricity was made. In 1827 Nobili demonstrated the electro-magnetic action of the current of the frog ; but it was reserved for Professor Matteucci, of Pisa, to recal the attention of experimenters to this subject. He has proved beyond doubt that electric currents are circulating through the muscles of a living animal, and that a current of positive electricity is moving from the interior of a muscle to its surface.

Matteucci has further shown, by a great number of experiments, that the muscular current is weakened by the intense heat of summer, as well as by everything which decreases the *vis vitæ* of the animal, as poisons, for example, sulphuretted hydrogen gas, &c. He has also demonstrated that the intensity of the current is proportionate to the activity of respiration and to the rank of the animal in the scale of creation, whilst its duration after death varies in the inverse ratio.

Matteucci has sought unsuccessfully for an electric current in the nerves of a living animal, and he came to the conclusion that the muscular electric current derived its origin from chemical action.

This conclusion of Matteucci has been refuted by the researches of Dr. Dubois-Reymond, of Berlin, who has experimentally demonstrated an electric current to exist in all parts of the nervous system.\* He assumes that the nervous current is produced by electro-motive molecules in the nerves, that the electro-motive elements in the nerves as well as in the muscles are to be considered as in the condition of a closed circuit, and that every current produced by a nerve is to be regarded as derived from a current circulating in the nerve itself.

That the muscles and nerves, including the brain and the spinal cord, are endowed during life with an electro-motive power.

That if any part of a nerve is submitted to the action of a permanent current, the nerve, in its whole extent, suddenly undergoes a material change

\* Untersuchungen über die thierische Elektrizität. Berlin, 1848.

in its internal constitution, and returns as suddenly to its former condition on breaking the circuit.

That the exciting current throughout the nerve sets in action electro-motive elements which turn all their positive poles in the direction in which the current goes, and their negative poles in the direction from whence it comes.

The existence of electricity in the body has now been proved, and we find it present in two states, one in a neutral condition or state of rest, the other in a state of current. In the former it is capable of being decomposed into its component elements ; for instance, if the negative pole is applied to the hand, and the positive to the back, a portion of this neutral compound is decomposed in accordance with the general law of electric induction that bodies similarly electrified repel each other, the electric current becomes polarized, and flows in a direction contrary to the normal current, which produces the effect of decreasing the quantity of electricity circulating in the nerves.

The electric current passes from the nervous centres, which are in a state of positive electricity, and the nerves conduct it to various parts of the body.

The effects of an electric current upon a nerve differ remarkably, according to the direction it pursues.

Muscular contractions are developed by a positive current passing in the direction of the nerves.

A direct current applied to a nerve of sensation will only excite contractions, and it appears the nerve will only obey the stimulus of a feeble current. An indirect one excites pain, but no motion. If in a living frog, the legs be separated from the trunk by the division of all intervening structure except the sciatic nerves, by which communication is kept up between the several portions, and a current be transmitted through the body of the frog along the nerves to the legs, violent convulsions will occur; whilst if the direction of it be reversed, there will be no motion whatever, but the frog will express its sense of pain by audible croaking.

A current applied to nerves of special sense only excites their proper functions.

In concluding, I shall refer to the chemical changes which are constantly taking place in the body through friction of dissimilar substances and

variation of the temperature of different parts of the body.

By every chemical process in which these changes take place the electricity becomes polarized, there can, therefore, be no doubt that this agent plays a very important part in the living organism,\* and that the quantity of polarized electricity in the body is very considerable.

No one will deny that animal life is chiefly a grand chemical process, that with each breath chemical changes are brought about, as the union of carbon with oxygen to form carbonic acid ; and the elements, hydrogen, phosphorus, and sulphur, constituting important ingredients in our food, become, by their oxidation, sources of free electricity.

The effect produced by electricity upon the different tissues of the living body will, of course, vary with its intensity and quantity, for if the current is

\* Chaptal relates the following curious anecdote of the Emperor Napoleon, who, on seeing the voltaic battery of the French Academy in action, remarked, "Voilà, l'image de la vie : la colonne vertébral est le pile, la vessie le pole positif, et le foie le pole négatif."

of great intensity it produces convulsions and contractions more or less violent. These movements are accompanied by painful sensations if the direction of the current is altered, which is always the case where an induced current is excited. If a series of powerful currents rapidly succeeding each other be passed through a limb, a state of complete tetanic convulsion is excited, accompanied, especially if the currents be alternately reversed, with sensations of intense pain.

These observations tend to show what my own experience has also proved, viz., that the majority of the electro-magnetic coils, as at present constructed, are not adapted for the medical administration of electricity, frequently, in fact, doing positive injury.

I have observed, on reading the accounts of those who employed galvanism in the treatment of disease with such success, that a battery of one hundred pairs of plates was required, and if the electricity from so many pairs was requisite, it is difficult to believe that a single pair of plates, even assisted by a coil, can bring to bear on the patient such a quantity of electricity as would be necessary.



It cannot, in my opinion, be too carefully borne in mind, that to be beneficially employed, the electric current must be of low intensity, large quantity, and flowing in one direction.

## CHAPTER III.

I SHALL now proceed to enumerate the various diseases in which this remedy exercises a beneficial influence, and then describe the method of its application.

## 1.

DISEASES IN WHICH THE FREE ELECTRICITY  
CIRCULATING IN THE NERVES SHOULD BE  
INCREASED.

*General Debility, Defective Circulation and Nervous Influence, Weakness and Atrophy of any particular Part. Puerile Incontinence of Urine. Paralysis of the Bladder from over distension. Suspended Menstruation. Flooding during Labour from an atonic state of the Uterus. Hypochondriasis and Hysteria. Indigestion. Constipation. Aphonia, or Loss of Voice. Some*

*cases of Deafness. Amaurosis. Paralysis. Asphyxia, or Suspended Animation. Narcotic Poisoning.*

## 2.

DISEASES IN WHICH THE FREE ELECTRICITY  
CIRCULATING IN THE NERVES SHOULD BE  
DECREASED.

*Profuse and painful Menstruation. To induce Uterine Contractions. Muscular Contractions. Writers' and Sempstresses' Cramp of the Hands. Rheumatic, Arthritic, and Nervous Pains. Neuralgic Pains of the Side in Hysteria. Headache. Tic Douloureux. Cramp of the Stomach, Chest, and Limbs. Chorea. Tetanus. Epilepsy.*

## 3.

DISEASES IN WHICH ELECTRO-CHEMICAL DECOMPOSITION SHOULD BE PRODUCED.

*Rheumatic Effusion into the Joints, provided it is perfectly fluid and not too old. Opacity of the Cornea. Leucoma. Paralysis of the Iris.*

*Cataract. Ecchymosis. Naevus. Stricture of the Urethra. Solution of Calculus in the Bladder. Chronic Glandular Tumours. Ulcers. Scirrhus and Cancer. And by the Electric Moxa to produce a discharging Sore in the place of an Issue or Seton.*

The therapeutic application of Electro-Galvanism requires no less consideration than that of any other powerful remedy. In applying a current of electricity to the human frame, the object is to act upon the static electricity in the body. By the application, for instance, of the positive pole, the corresponding electricity contained in the body (which was in a state of equilibrium) is set free and circulates in larger quantities in the nerves, the combination of the positive current from the apparatus with the negative in the body forming a neutral compound. An opposite result, of course, follows the application of the negative pole. The normal current circulating in the nerves should be increased when there is a deficiency of electricity in the system, and decreased when there is an excess. In health there exists a certain quantity

of the electric fluid in the nerves, which is increased or diminished by disease.

With regard to the use of this remedy, it is important to observe that, in treating the diseases enumerated in the first and second division, the application ought not to be painful. The sensation produced by the passage of the current should be no stronger than a slight pricking, similar to that felt in a limb which is asleep: when it exceeds this, the application is not attended with so much benefit.

The diseases mentioned in the third division require to be acted upon more powerfully, and the closer approximation of the electrodes causes greater pain; but the application being merely local, it is not followed by any unfavourable constitutional symptoms.

As a general rule, the application of the electric current to the diseases named in divisions first and second should not be continued longer, when only applied to one part, than from ten to fifteen minutes; but should it be thought desirable to apply it more generally, the length of the appli-

cation may be extended to from twenty to thirty minutes. Persons of great nervous susceptibility will sometimes be met with, who cannot bear it for so long a time.

One application a day is usually sufficient ; but there are cases which derive benefit from a more frequent use of the remedy, and others, again, which require it only on alternate days. The feelings of the patient must be consulted in regulating the strength of the current ; but I should advise always beginning with the weakest power, and gradually increasing the strength so long as the application does not induce pain.

In those cases which require an increase of electric activity to supply the deficiency of the current in the nerves, the negative electrode must be placed either on the spinal column, the forehead, the temples, or nape of the neck ; and the positive applied to the hands, feet, or abdomen, according to the part affected, which it is necessary to bring as much as possible under the direct influence of the electric fluid.

In those cases which require the quantity of

electricity circulating in the nerves to be diminished, the positive pole must be placed on the back, the negative on the part affected.

In the diseases alluded to in the third division, where the local application of the electric current is to produce chemical decomposition, no indications can be given ; and the mode of applying the current must be left to the judgment of the medical attendant.

The electric current can be more advantageously and conveniently applied by another than by the patient himself, as the operator is able to employ a larger quantity of the fluid with no more sensation to the patient than the slight crackling he would experience on rubbing a cat's back the wrong way of the coat. When applied in this way, one electrode is placed on the patient, the other is grasped by the operator, who with the backs of the fingers of the disengaged hand gently rubs the part affected.

## CHAPTER IV.

REMARKS ON THE APPLICATION OF THE ELECTRIC  
CURRENT IN THE TREATMENT OF THE DISEASES  
BEFORE MENTIONED.

I MUST preface these remarks with the observation, that though very decided relief is frequently experienced after a single application, it must not be looked for as an invariable result. Chronic affections of long standing require perseverance in the continued use of the remedy; and there are few cases but which, if they do not absolutely yield to its influence, at least derive some benefit from it. I do not advocate this agent to the disparagement of other modes of treatment, but regard it as a very important auxiliary; and my own experience bears testimony to its value in combination with medicine, where it is probable that either tried singly would have failed.



## 1.

DISEASES IN WHICH THE FREE ELECTRICITY  
IN THE NERVES SHOULD BE  
INCREASED.*In General Debility.*

The employment of the electric current is invariably attended with benefit. It must be applied chiefly to the back when the debility is general, and to, or as near as possible to, the part affected, when it is more local. At the same time, attention to the diet, combined with judicious medical treatment, will materially assist the cure.

*Incontinence of Urine.*

Dr. Froriep has met with great success in his treatment of this most distressing infirmity. His plan consists in introducing the electric fluid by one pole into the bladder, whilst the other is applied over the pubes.

*Paralysis of the Bladder.*

Electro-galvanic currents have been successfully

applied to the bladder, where from over-distension, during labour, it has lost the power to expel its contents, requiring the daily use of the catheter. The electro-galvanic current speedily restores the organ to the dominion of the will. In hysteria, paralysis of the muscular fibres of the bladder, or spasm of its sphincter, sometimes occurs, which an electro-galvanic current will succeed in removing.

### *Amenorrhœa.*

#### *(Absent and Suppressed Menstruation.)*

There are two very distinct classes of amenorrhœa, one where the menses have never appeared, and which has received the name of absent menstruation; the other, in which having continued regularly for some time, they have ceased: this is called suppressed menstruation.

In those cases where no congenital malformation exists, I venture to say, that the electric current will always be attended with success, even after all the usual remedies have been tried in vain.

In this disease, it is essentially necessary to combine medical with electrical treatment. Our first

object is to strengthen the system by a well-arranged nutritious diet, moderate use of wine, exercise, and some preparation of iron ; and when we have succeeded in improving the general health, but failed in producing the menses, we must have recourse to those remedies which possess a specific power over the uterine secretion, and the one I have never found to fail is electricity. “ In electricity,” observes Dr. Bird, “ we possess the “ only really direct emmenagogue with which the “ experience of our profession has furnished us. “ I do not think I have ever known it fail to “ excite menstruation, where the uterus was capable “ of performing this function. Disappointment “ will, however, most certainly result, if we have “ recourse to electricity, merely because a girl does “ not menstruate : we must never lose sight of the “ fact that, after all, the large majority of cases of “ amenorrhœa depend upon an anæmic condition, “ and that the patient does not menstruate simply “ because she has no blood to spare. Nothing “ can be more ridiculous than applying electricity, “ or any other local stimulant, to the uterus, when “ chlorosis exists ; the first great indication will

“ be to restore the general health, give iron to  
“ make up for the previous deficiency of that ele-  
“ ment in the blood, and then, and not before,  
“ think of stimulating the uterus. A few shocks  
“ transmitted through the pelvis, seldom, if ever  
“ fail in effecting menstruation.” I have repeatedly  
known the catamenia, although previously absent  
for months, appear almost immediately after the  
use of electricity; in more than one case the dis-  
charge actually appeared within a few minutes.

### *Flooding during Labour.*

We are indebted to Dr. Radford, of Manchester, for suggesting the employment of electric currents to induce energetic contraction of the uterus, and the success which has followed its use has been confirmed by others. A fatal case of uterine hæmorrhage having occurred, Dr. Radford was forcibly impressed with the want of some means on which we might always depend for producing uterine contraction, and so place the patient in such a state of safety that the operation of labour might be deferred. These views he mentioned to

some medical friends, who fully coincided in them, and soon afterwards Dr. Radford had an opportunity of testing their correctness. He was called in consultation to a case of frightful hæmorrhage during labour, attended with extreme exhaustion, and where the os uteri was so rigid that the advocates of delivery could not possibly have carried their views into practice without laceration. In this case he proved that electric currents produced as effective and powerful a contraction of the uterus as that which is observed in normal labour. He expresses his conviction that the life of the child in utero is not endangered by the application, and that in after hæmorrhage, especially that attended by exhaustion, where atony of the uterus is the principal feature, it is particularly useful.

Mr. Dorrington read a paper before the Manchester Medical Society,\* in which he states his belief that galvanism is one of the most valuable additions which has been made to our obstetrical armamentarium in modern times. He believes that the treatment of placenta prævia, by removal

\* Dr. Ranking's half-yearly Abstract of the Progress of Medical Science.

of the placenta, can be very rarely required ; whereas the application of galvanism is serviceable in many cases which frequently occur. Mr. Dorrington, in alluding to a case which he had attended, remarked that, although unfortunate, it was one of the most satisfactory cases he had seen, as it was from the beginning considered impossible the woman could live to be delivered. Coupling her exhausted state with the undilated and undilatable condition of the os uteri, and the fact that hæmorrhage was in all probability continuing, rendered it one of the most formidable cases that could be met with. Ergot having been administered before the galvanism was used, enables us to compare the relative effects of the two remedies, and the difference was most marked. The action brought on by ergot did not occur till twenty minutes or half an hour after its administration, the contractions were not nearly so strong, and the uterus, in the intervals between the pains, remained soft and doughy. The action brought on by the galvanism was instantaneous, the contractions were much stronger, and the galvanism acted as a general stimulant. He alluded to another

case of accidental hæmorrhage before labour, where the uterus was dilated to the size of half-a-crown, the head presented, but no portion of the placenta could be detected, the membranes were ruptured, and a considerable quantity of liquor amnii came away, but no probability of labour occurred. As it was not impossible that insidious internal hæmorrhage might take place, galvanic shocks and currents were applied, both in the longitudinal and the transverse axis of the uterus. The firmest tonic contraction came on the moment the organ was stimulated; and when the conductors were finally removed, a good tonic state of the organ existed. It roused the woman, and, in her own words, "made her feel better than she had done for months." Labour commenced nineteen hours after the galvanism was applied, without any further hæmorrhage having occurred, and terminated in about two hours and a half. Had the ergot of rye been used, the probability is that the child would have been born dead, and the labour forced on before the os uteri was prepared to dilate. In another case of placenta prævia hæmorrhage occurred both before and during labour. The os

uteri was found oval in shape, dilated to the size of a penny-piece, tolerably dilatable, and almost entirely filled up by the placenta. The membranes could just be felt anteriorly, and they were ascertained to be unruptured, and the head presented. There had been occasional slight labour-pains. The case was thought favourable to try the experiment of delivering the child without turning, by means of the uterine action induced by galvanism, combined with artificial rupture of the membranes. At a quarter to 2 P.M. the conductors were applied in the usual way, and good strong uterine action set in at once. In about ten minutes the membranes were ruptured with Holmes's stilette, and the galvanism continued till twenty minutes past 2 P.M., by which time the pains had begun to come on spontaneously at intervals, and the placenta had fallen down to a considerable extent into the vagina; the hæmorrhage was extremely slight. At 3, the labour-pains were regular, and the foetal heart audible. At 5 P.M. the uterine action was not so strong, and very little change had taken place. There was no hæmorrhage. Galvanism was reapplied, using a greater power.



The os uteri was dragged into the axis of the vagina, as an obliquity of the organ appeared to prevent the head from entering the pelvis. In an hour there was a decided advance ; the head had descended into the brim of the pelvis, and was dilating the os uteri rapidly, and there was no further flooding. The placenta continued to descend before the head. When the child was born, its most depending portion was protruded from the os externum before the head, so that the child passed over the half-detached placenta along the vagina. The child was born dead, though the foetal heart was audible till half an hour before its birth. The placenta came away immediately after the child ; the labour was terminated at twenty-five minutes to 7 P.M., and the woman recovered well.

Dr. Johnson relates a case of profuse uterine hæmorrhage of a fortnight's continuance. The most powerful internal and external remedies had been resorted to, yet there was every appearance of the patient sinking ; the os uteri was patulous, and seemed to be quite impassive, and in such an atonic state as to be incapable of contraction. A

moderate galvanic current was passed through the uterus, which was found to contract very forcibly.

Mr. Wilson, of Runcorn, also describes an alarming case of uterine hæmorrhage, attended by syncope and convulsions, pregnancy having advanced about two months. The patient was pulseless, her extremities cold, and she was thought to be dead; reaction occurred under the use of stimuli, the hæmorrhage returned, and the case appeared utterly hopeless, the pulse was doubtfully perceptible, the eyes rigidly open and fixed, and death seemed imminent. The electro-galvanic current was applied for some time, when she began to rally; there was no return of the hæmorrhage, and the patient recovered.

“ Few cases,” says Dr. Bird, “ are more appalling than those of flooding during labour. Among other causes inducing this hæmorrhage an atonic state of the uterus is the most dangerous. In such cases, where the blood is fast gushing from the uterus, and the woman’s powers as rapidly sinking, a distinguished physician has advocated the employment of electric currents to induce energetic contraction of the uterus. He has further

“ suggested its application for the purposes of ori-  
“ ginating uterine contractions de novo in cases  
“ where it is important to induce premature labour,  
“ as well as in certain cases of menorrhagia in the  
“ unimpregnated state, where the uterus is found  
“ large, atonic, and flaccid. It has occurred to me  
“ more than once to notice the occurrence of abor-  
“ tion as the results of the transition of electric  
“ shocks through the pelvis in cases of supposed  
“ amenorrhœa ; I have, therefore, not the slightest  
“ doubt that the electro-magnetic current is, in  
“ some cases, quite competent to set up uterine  
“ contractions.”

### *Hypochondriasis and Hysteria.*

Electric currents have been applied in the treatment of these diseases with the most satisfactory results. It is first necessary to restore the energy of the brain and nervous system, and to improve the general health. The first application is usually followed by some improvement, but the treatment must be continued for two or three weeks to produce permanent benefit. The application should

be made by rubbing the part to which the electric fluid is to be applied, either with the hand or cylinder.

### *Indigestion.*

The beneficial influence of the electro-galvanic current is experienced after a few applications by removing the nausea, distension, weight, oppression and spasmodic pains of the stomach, the general languor and debility, and by giving a tone to the stomach. The hand should be employed in applying the current, by rubbing the abdomen, to avoid the burning sensation experienced when the conductor is applied.

### *Constipation.*

We have in Galvanism a safe, gentle, easily-regulated means of acting on the bowels to any required extent, whether the intention be to produce brisk evacuation or to imitate the process of nature. Aldini exemplified the power of electricity in inducing defecation in the following manner. He placed a zinc plate in the mouth of a recently-

killed ox, and a piece of silver in the anus ; on connecting them with a piece of wire, the abdominal muscles were convulsed and a discharge of fæces occurred. The same effect has constantly followed the repetition of this curious experiment. Dr. Ritter, by merely holding in his hands the poles of a battery of one hundred pairs of plates for half-an-hour brought on active diarrhœa. The current should be passed from the nape of the neck to the abdomen, and across the abdomen in the direction of the transverse colon.

### *Aphonia, or Loss of Voice.*

The passage of an electro-galvanic current through the larynx, in the treatment of this complaint, is attended with the most gratifying results. At the same time the general health must be restored by tonics, &c.

### *Deafness.*

The electro-galvanic current is of great benefit in all cases in which no organic changes have taken place. Also in nervous deafness, when the infirmity

proceeds from general debility, and varies in degree with the weather and general health of the patient. The application should be made with great care, and should it produce a humming noise in the ears, which ceases with the current, the patient may be sure that it is doing good.

### *Amaurosis.*

The impairment of vision, which is the first and most prominent symptom in this disease, arises from some change in the retina, optic nerve, or brain. It may be caused by long-continued exertion of the eye in viewing minute objects, exposure to glaring light, by any exhausting disease, by certain narcotico-acrid poisons, or it may be a consequence of organic change, inflammation, or concussion. This disease has been treated most successfully by the electro-galvanic current; but the application requires to be conducted with great care, and never should be attempted by those unacquainted with the minute anatomy of the delicate organs which are the seat of this disease. M. Majendie has treated, by puncturing the frontal

nerve and the superior maxillary nerve, many cases of imperfect amaurosis with or without paralysis of the muscles of the eye, and almost in every instance with very advantageous results. M. Majendie observes, thus it is proved that the puncture of the orbital branches of the fifth pair of nerves is by no means dangerous.\*

### *Paralysis.*

In no class of diseases has the power of the electro-galvanic current been so frequently tried as in cases of paralysis affecting the body either generally or locally. When the affection proceeds from other causes than congestion or cerebral mischief, it is invariably much benefited by this remedy.

Paralysis may proceed from congestion or other cerebral mischief, exposure to cold (a very frequent source of what is called rheumatic paralysis), certain poisons, of which the most frequent is lead, and from exhaustion and enervation.

For an account of the successful application of

\* Journal de Physiologie, tom. vi.

this remedy to rheumatic paralysis, the reader is referred to my work on the Therapeutic Application of Electro-Magnetism in the Treatment of Rheumatic and Paralytic Affections.

In the Haarlem Transactions a case is recorded of a patient who recovered the use of his side after receiving a hundred shocks from the electric eel ; and in the Medico-Chirurgical Review the following curious circumstance is related :—In consequence of a vessel on the Atlantic having been struck several times by lightning, many of her crew were strongly electrified. Among the passengers was a man who had been paralysed in both his lower extremities for three years ; at the time of the electric discharge he lay on his bed, but soon after perceived the return of power and sensation in his limbs, and was enabled to rise with the perfect use of them. The cure in this instance was permanent.

When the cause producing this complaint is no longer active, the electro-galvanic current cannot act injuriously ; and in the great majority of cases it will be followed by relief, though in those of long standing the improvement progresses slowly, in consequence of the new tissue which has been



deposited and become organized, but has never contracted at the will of the patient.

*Asphyxia, or Suspended Animation.*

Electricity has yet another application in connection with human suffering, still more wonderful than that which it receives as a remedy for pain and disease.

Through its agency the feeble flame of life has been revived when, to all appearance, it was hopelessly extinguished. It has been used to restore suspended animation in persons apparently dead from drowning, narcotic poisoning, or the use of chloroform.

I cannot prove the wonderful resuscitating power of the galvanic current better than by quoting several well-authenticated cases.

The following case was published in "The Lancet" of July 17th 1852 :—

"*Guy's Hospital*.—Amputation of little finger ;  
" dangerous symptoms manifested after the admi-

“ nistration of chloroform ; resuscitation by galvanism.

“ We are happy to state that the galvanic excitation of the diaphragm has been proved, by the following case, to be most valuable in threatened suspension of the respiratory act after the use of chloroform, and we hasten to lay the particulars before our readers, with the sincere hope that the same means will in other hands be followed by similar results.

“ C. R——, aged 29, was admitted under the care of Mr. Hilton, June 16, 1852, in consequence of the fifth metacarpal bone of the left hand being in a state of active disease, and of her being advised to have it removed. On the 26th June 1852, the patient, at her own express wish, was placed under the influence of chloroform, of which three drachms were given. At the completion of the operation the patient manifested perfect consciousness, and answered questions slowly, but correctly. As she felt comfortable, and expressed a wish to walk back into the ward to her bed, and not be carried, she was assisted by two attendants, whilst rising from the table ;

“ but no sooner did she gain the erect posture,  
“ than she fell back into the arms of those who  
“ were supporting her, and relapsed into a state of  
“ insensibility. Doors and windows were imme-  
“ diately opened, cold air admitted and thrown in  
“ currents across the patient’s face by fanning ;  
“ cold water was dashed upon face and chest, by  
“ which an occasional sighing inspiration was ex-  
“ cited. Brandy and cold water were freely given,  
“ and strong ammonia applied to the nostrils.  
“ Respiration was now aided by compressing the  
“ sides of the chest, with the palms of the hands  
“ firmly applied, during the act of expiration, but  
“ without satisfactory results. After a trial of two  
“ hours and a half of the remedies just described,  
“ as the danger was becoming imminent, the gal-  
“ vanic apparatus was procured, and shocks were  
“ passed and continued during two or three minutes.  
“ This produced the happiest results.

“ The patient raised her body from the bed,  
“ sighed frequently and profoundly ; a general tre-  
“ mor, of about a minute’s duration, ensued, at the  
“ end of which she opened her eyelids, complained  
“ of pain and fulness in the head, and answered

“ questions correctly. The operation has been perfectly successful, and on the 17th July, one month after admission, she was presented cured.”

The details of the treatment exemplify, in a most striking manner, the utility of galvanism or electricity in such cases, as a resuscitative agent. The galvanic shocks had not only the effect of producing a marked improvement in the pulse and respiration, but they also produced dilatation of the pupils and complete return of consciousness. That the galvanism deserves the credit of effecting resuscitation, cannot be doubted, from the fact of the previous remedies having proved ineffectual, and from the speedy recovery immediately upon its administration.

Cases are constantly appearing in the medical papers of even the youngest infants who have been saved by the use of this powerful remedy alone in cases of narcotic poisoning.

Mr. Tubbs, of Upwell, relates the case of an infant only three weeks old, who had had a tea-spoonful of Godfrey's cordial given to it, and appeared dead from the effects, but was resuscitated by means of the electro-galvanic current.

The first care should be to remove as much as possible of the poison from the stomach, but this done, the real difficulty of the case begins.

The great peril besetting the patient is the fatal indulgence of sleep ; and this danger was averted under the old form of treatment by many expedients which were of necessity rough and cruel. Modern science supplies us with more effectual and desirable means in the stimulating powers of electricity.

The electric current must be applied by placing the negative electrode at the nape of the neck, and the positive electrode at the pit of the stomach ; if this does not act with sufficient power, insert a needle between the eighth and ninth ribs on either side, so as to reach the diaphragm, and then allow the current to pass. The current must not be applied too strongly, or otherwise we may defeat the object we have in view.

## 2. DISEASES IN WHICH THE FREE ELECTRICITY IN THE NERVES SHOULD BE DECREASED.

### *Profuse and Painful Menstruation.*

The general symptoms in profuse menstruation are exactly those we should anticipate from the continuance of a debilitating discharge, viz., exhaustion, languor, and dislike of exertion, weakness across the loins and hips, paleness of the countenance, headache, throbbing of the temples, and giddiness.

In painful menstruation there is most frequently defective secretive power, accompanied by severe pain, which is the distinctive symptom of this disease. The amount of pain varies very much ; it may be moderate, lasting for a few hours each time, or it may be so severe as seriously to derange the health of the patient. This disorder is generally confined to those of a nervous temperament, and of a thin, delicate habit of body. The monthly paroxysms present all the characters of neuralgia. From the statements which I have already made concerning the effects of electricity, it will be evi-

dent, after the above short description of the main symptoms of these diseases, how much benefit would result to the patient from the electro-medical treatment. As far as my own experience goes, I can say it has been attended with the happiest results.

*Induction of Uterine Contraction.*

Dr. Radford, of Manchester, has advocated the employment of the electro-galvanic current to induce energetic contraction of the uterus in cases where it is important to bring on premature labour.

Mr. Cleveland\* mentions a case in which premonitory symptoms of labour came on and then ceased. Tincture of ergot was administered, followed by a few slight and ineffectual pains, and exhaustion coming on it was deemed advisable to terminate the case. He therefore determined to apply the electric current. After a few applications a very decided effect was produced. Regular, strong, and frequent pains came on, and in the

\* Medical Gazette, 1847.

course of a quarter of an hour a living male child and placenta were expelled, attended with the least degree of hæmorrhage he had ever witnessed. The uterus was immediately firmly and permanently contracted.

Dr. Lever has availed himself of the use of the electric current in cases where atony of the uterus existed, and where, from threatening exhaustion, independent of danger of hæmorrhage, immediate delivery was important.

Mr. John Dempsey mentions a case in which, in consequence of pelvic malformation, he determined to induce premature labour at the seventh month. Accordingly at the end of this period he punctured the membranes, and waited forty-eight hours to see what effect this would produce. At the end of this time there was no appearance whatever of labour. For five minutes a gentle current was passed in the usual way; no effect followed. Ten minutes elapsed; current passed again for five minutes, still no effect: another ten minutes' interval. A third application for five minutes: patient now complained of a slight grinding pain, quickly passing off. He determined to



wait half an hour to ascertain what effect the impetus given to the uterus would produce in keeping up its action; no pain or contraction ensued. For forty minutes the current was regularly transmitted for five minutes, at intervals of ten minutes; the pains now became steady and regular. On this being accomplished the action of the machine was discontinued. He sat by this patient eight hours, regularly noting by his watch each pain and its duration. The pains regularly occurred within twenty seconds of the ten minutes, lasting for twenty-five seconds, until the head rested on the perineum; then for eight minutes, six, four, two, one, and half a minute, the last expelling the head.

In another case in which labour was protracted for nearly thirty hours, pelvis capacious and well-formed, uterine action extremely feeble, with long intervals. When first seen the patient had been fainting for two hours, within short periods. On inquiry it was ascertained there had been no pains for nearly three hours. Electro-galvanic current applied in the usual manner. On the first application patient complained of slight bearing-down

pain. In five minutes applied again ; now the pain is decided and energetic. After forty minutes the foetus is expelled alive and strong, the current having been passed every five minutes. In this case ergot had been administered freely previous to his having seen the patient.

In conclusion, I have no hesitation in stating, that the electro-galvanic current is capable of inducing uterine action *de novo* in those cases in which, from the peculiar formation of the pelvis, it is not possible for the woman to bring forth a living child at the termination of the nine months ; and in which we wish to bring on artificial premature labour. Also, in those cases where uterine action is insufficient from debility, and the pains after a while cease altogether, the electric current is capable of exciting uterine contractions, and of bringing a labour to an end in a shorter time than any medicine we know of : and, lastly, that its application is never attended with any injurious consequences.

### *Muscular Contractions.*

Contractions of various muscles take place at

different periods of life, and may produce either permanent deformity, or may be relieved by removal of the cause, which gives rise to the contractions. The muscles become wasted and stiffened from inaction, after injuries, fever, exposure to cold, or some affection of the nerves. The affected limb is cold, numb, imperfectly nourished, and ceases to grow in proportion with the other parts of the body; the flexor muscles often become so rigid as to produce dislocation of the bones to which they are attached.

Electricity will, in most cases, completely restore the affected limb.

### *Writers' and Sempstresses' Cramp of the Hands.*

Many unavailing remedies have been tried in the treatment of this affection, the continuance of which produces a contracted state of the fingers and hands, depriving the individual of their use. The electro-galvanic current will, in a short time, accomplish a cure: for cases, I must refer the reader to my work on the Therapeutic Application, &c.

*Rheumatic and Arthritic Pains.*

In these, the application of the electro-galvanic current is always attended with relief. I must refer the reader to my former work, where sciatica and other rheumatic pains are fully treated of.

*Neuralgic Pain of the Side in Hysteria.*

This pain, so common in females of the hysteric constitution, which is oftener complained of in the left than in the right side, and has been so frequently ascribed to inflammation, and actively treated with leeches, blisters, and blue pill, when no such inflammation existed, will quickly yield to electro-medical treatment.

*Headache.*

Headache is a symptom of almost all acute and chronic diseases of the brain, as well as a distinct functional derangement of very frequent occurrence. The cause of headache should be carefully inquired into, and in those cases where the electric

current is indicated, speedy and positive relief will be derived from its use.

Hemicrania is simply headache confined to one side, and occupying generally the brow and forehead; but sometimes affecting, very exactly, one moiety of the head. It is attended with sickness, and is frequently periodical, and recurring at variable intervals; but always lasting a certain time, and then subsiding. It is produced by various causes, almost all of which tend to debilitate the system. In the treatment of this complaint, the patient derives signal benefit from the combination of electrical and medical treatment.

Mrs. S——, forty-five years of age, health delicate, had been suffering for several months from hemicrania when I first saw her. The pain was at times so intense as to deprive her of all rest. Sharp lancinating pains commenced at a fixed spot over the left eyebrow, which place was always more or less painful on pressure. From this spot they crept gradually over the whole of the left side of the head, and subsided into a dull heavy pain. I applied the current to the head by means of my hand, gently rubbing the seat of pain. The

patient could not bear the application longer than five minutes, as the pain was increased by it; but, after a few hours, she felt it had greatly diminished, and she passed a better night.

On the second day the application produced the same effect, but the pain subsided within a much shorter period, and the patient had a good night's rest.

On the third day a less degree of pain was produced by the current, and that subsided with its discontinuance.

On the fourth day, she had had no pain since I saw her. I again applied the current with the same effect, but the pain entirely ceased in a quarter of an hour, and she has now remained free from it for several months.

Miss M——, nineteen years of age, a healthy, robust young woman, was attacked with pain in the head, brought on by mental anxiety. Had been suffering for several months when I saw her. The current did not produce pain as in the last case, and she was perfectly cured by six applications.

Miss D——, eighteen years of age, was suffering from severe shooting pains about the head, in

consequence of having caught a severe cold. The first application diminished the pain very considerably, and it was quite removed by the third.

Miss C —, twenty-one years of age, had been suffering more than three years from intense pain on one side of the head. In the commencement of the complaint, attacks occurred at intervals of a few days, but with its continuance they had increased in frequency and severity. When I first saw this young lady, the pain occurred daily, lasting for several hours. She was pale, exhausted, had a care-worn expression, and was much depressed. The hands and feet were cold, all her functions were deranged, and her general health had suffered by the continuance of the complaint, and the means which had been adopted to relieve her, as bleeding, blistering, mercury, &c. I applied the current daily, but it was not until after the sixth application that she began to derive any apparent benefit, when she gradually but satisfactorily continued to improve. The application was continued for six weeks, and during the latter half of the time, only on alternate days. At the expiration of that period, she was quite restored to

health, and has not had another attack now for upwards of twelve months.

*Tic Douloureux.*

We now come to those cases in which a single part or nerve is the seat of pain. The face is the most exposed, and, therefore, most frequently affected; generally, the parts supplied by the facial branches of the fifth pair of nerves—nerves of sensation. The torture occasioned by this dreadful affection is sometimes excessive. The sufferers speak of it as anguish that is scarcely endurable, and you see in their quivering features and restless limbs that the acute bodily pang is, indeed, hard to bear.

This affection may continue for years. The fact that there exists so great a number of specific remedies for this complaint, each of which has been known or supposed to accomplish a cure, affords one of the strongest evidences of the intractability of the disease.

In this complaint we see the advantage of electro-medical treatment, and in those cases in



which medical treatment has been employed without avail, the combination will prove most gratifying to the medical attendant and beneficial to the patient.

Mrs. M——, thirty-eight years of age, the mother of several children, and living in a damp situation, consulted me in 1848. She had been suffering for seven years the most excruciating pain, had consulted many medical men and tried various remedies, but without deriving any benefit. She was in bed when I first saw her; her person was emaciated to a degree owing to a want of nourishment, for no solids could be given her, the teeth being clenched, and not more than a teaspoonful of fluid at a time, as she said she would rather die than suffer the horrid torture of the liquids flowing over the tongue, which always brought on an attack of pain, as did the slightest movement of the lips or head. I attended this lady daily for a fortnight, applying the galvanic current, and putting her under a course of medicine; at the end of that period she went by my advice to the sea-side, perfectly free from pain, to improve her general health.

Mr. W. M——, a confectioner, consulted me on account of the pain in the face brought on by the change of temperature unavoidable in his business. I applied the electro-galvanic current three times, when he was perfectly well. I could multiply these examples, and refer the reader to my book before alluded to.

The application of the electro-galvanic current produces in many cases a profuse perspiration, which I am always very pleased to see, for, according to my experience, it promises a successful result of the treatment. On its appearance there is a marked improvement and decrease of pain, and the patient, who has been deprived of sleep for nights, will go home and sleep soundly for hours.

Dr. Prösch, of Hamburg, bears testimony to the superior efficacy of the galvanic current when employed by acupuncture, especially in neuralgic pains.

### *Cramp of the Stomach, Chest, and Limbs.*

The electric current, when properly applied, is followed by immediate relief in all spasmodic affec-

tions. A single application has frequently effected a permanent cure, and in no case have I found it necessary to continue the use of the remedy for a longer period than a week.

It may occasion some surprise when I mention asthma as a disease which, when there is no organic mischief, will derive benefit from the electric current; but a short account of this complaint will suffice to prove the correctness of my views. Asthma may be defined as being great difficulty of breathing, occurring in paroxysms, which are believed to depend upon a spasmodic contraction of the bronchial tubes. The rapidity with which the dyspnœa comes on, and the suddenness with which it often abates, resembles the caprice of spasm; the secretion of hysterical urine marks also the nervous character of the symptoms. It is no uncommon circumstance for an attack of asthma to be accompanied or succeeded by actual cramp of the muscles of the calves of the legs.

Dr. Williams has demonstrated the contractibility of a bronchus under the influence of an electric current; and as we know that the air tubes are encircled with a series of little fibres, or bundles of

fibres, and supposing these circular fibres to be muscular, it becomes at once likely that they, no less than other muscles, should be liable to spasm. Professor Todd and Mr. Bowman state that these fibres are actually muscles, of the unstriped kind, like other involuntary muscles, subserving the organic life. We may, therefore, conclude that asthma is one of the spasmodic disorders of the excito-motory system of nerves. Many cases have been relieved by the electro-galvanic current, and a considerable shortening of the periodic attacks, when present, will be effected through its agency. Dr. Wilson Philip says —“ I have employed galvanism in many cases of habitual asthma, and “ almost uniformly with relief.” In cramp of the calves of the legs, when all the usual remedies have been tried and failed, the application of the current for a few minutes will act as a charm in removing the spasm and pain. Several cases which have come under my observation have been cured by a few applications of the electro-galvanic current.

*Chorea.*

This is a spasmodic disease, essentially belonging to the nervous system. The ordinary movements of the body are in some degree under the direction of the will; but sometimes it appears as if some other power opposed the will, and excited them when they are not wanted.

Dr. Hughes, of Guy's Hospital, has often observed the very remarkable influence of electricity in this affection. When the body has been wasting, the mind apparently giving way, and the disease proceeding unchecked by other means, he has seen this agent effect a cure. The following is the result of thirty-seven cases treated at Guy's Hospital: thirty were completely cured, five were relieved, and two uncured. Cases of rheumatic chorea are generally obstinate, but still appear to yield readily to electricity. Dr. Bird has observed that the more extended his experience the greater his confidence in this remedy, and he cannot otherwise account for its failure in the hands of others than by attributing it to the mode of application. He says that most satisfactory results have followed

when he has suggested its use in private practice, in cases which had run the gauntlet of all kinds of treatment in vain.

### *Tetanus.*

This disease is characterised by an involuntary, long-continued, violent and painful, contraction of the voluntary muscles of various parts, or of nearly the whole body. The muscles that seem in general to be the earliest affected are those of the neck, jaws, and throat; and at length the jaws close with great firmness. In the Philosophical Transactions, and in the London and Dublin Medical Journals, several cases will be found in which decided relief has followed, and in some instances perfect cures have been effected by the use of electricity. Two cases have been related to me, in which immediate benefit resulted from a few minutes' application, and in both the continued use of it effected a cure within a fortnight.

### *Epilepsy.*

There are a few cases on record which have been benefited by electricity, but from my own

experience I can contribute no further information. The younger the patient, and the more recent the complaint, the greater will be the chance of the electric current being of service.

### *Hydrophobia.*

The following remarkable case of recovery from hydrophobia by galvanism would scarcely be credited but that it is well attested. It is extracted from a "Report presented to the Class of the "Exact Sciences of the Academy of Turin, on "the Action of Galvanism," by Signior Vassalli Eandi :—

"A man, bit in the finger by a mad-dog, came to consult M. Rossi in consequence of a pain which he felt in the arm, the back, and particularly the finger, which had been bitten more than a month. Caustic, applied to the finger, removed the pain, but a few days after it returned, accompanied with symptoms of hydrophobia. The patient could no longer look at water without horror; an inflammation in the throat prevented him from swallowing even chewed bread, and he

“ experienced a strong propensity to bite those  
“ around him.

“ In this state he was brought to M. Rossi, who,  
“ observing that he could not bear the sight of  
“ water, nor that even of shining bodies, provided  
“ in another room a pile consisting of fifty pairs  
“ of plates of silver and zinc, intermixed with fifty  
“ pieces of pasteboard, moistened with a solution  
“ of muriate of ammonia. He employed slips of  
“ brown paper, moistened, as a conductor, on which  
“ the naked feet of the patient were placed, and at  
“ the moment when he opened his mouth to bite,  
“ one end of the arc was thrust into it, while the  
“ other communicated with the pile. The patient  
“ suffered a great deal from this operation, which,  
“ after several shocks, weakened him so much that  
“ he could no longer support it. Being stretched  
“ out on the floor, he was then galvanized with  
“ ease: the operation made the sweat run from  
“ him in drops. After some time Rossi caused the  
“ patient to be conveyed home, and gave orders  
“ that he should be brought back next day, to the  
“ end that the operation might be repeated. It  
“ was two o'clock in the afternoon when the patient



“ was galvanized, and at six next morning he came  
“ to Rossi himself to tell him that he was com-  
“ pletely cured, as he experienced no pain or  
“ difficulty of swallowing, and was entirely freed  
“ from his aversion to water, and to liquids. No  
“ persuasion, however, could induce him to submit  
“ to a new operation.

“ But a few days after some slight pains having  
“ given him reason to apprehend a new attack of  
“ hydrophobia, he returned to Rossi, who, by re-  
“ peating the operation, made all the symptoms  
“ disappear. This cure was effected in the presence  
“ of several persons. The patient was endowed  
“ with so great sensibility, that for more than a  
“ month after he felt in the shoulders a sensation  
“ of the galvanic shocks, which I experienced only  
“ as far as the articulation of the fingers, though I  
“ am not one of the least sensible.”\*

\* Journal de Physique, tom. lvi.

### 3. DISEASES IN WHICH ELECTRO-CHEMICAL DECOMPOSITION SHOULD BE PRODUCED.

Experiment has long since proved the influence which voltaic electricity exerts over affinity ; and to such an extent that compound bodies in which the component parts are united by the most powerful affinities, are not only decomposed, but their elements are transported to great distances, and are even carried through substances without combining, to which they nevertheless have a strong attraction, and to which they otherwise would have united.

Sir H. Davy, having placed his fingers, previously well wetted in distilled water, in the positive part of the voltaic circuit, phosphoric, sulphuric, and muriatic acids rapidly passed into the water from his body. On making a similar experiment at the negative side, fixed alkali made its appearance. “ Now,” says Becquerel, “ since acid and “ alkaline substances can thus be separated from “ their combination in the living body by means of “ electric power, there is reason to believe that by “ the same means may be introduced into the “ living body different substances capable of re-

“ acting on the organs in different pathological cases.”

Dr. Fabré Palaprat\* has made some experiments, which seem to promise great results, if the subject be sedulously followed up by the profession. They were as follows :—After having dried as much as possible both arms of a woman, he applied to one of them a compress soaked in a solution of iodide of potassium, which he covered with a plate of platinum, in communication with the positive pole of a pile formed of thirty elements, and charged with a liquid adequate to produce decomposition. He placed on the other arm a compress moistened with amidine, which being covered with a plate of platinum, was made to communicate with the negative pole. In a few moments the amidine had assumed a blue colour, clearly proving that the iodine had been transported through the interior of the body, since the skin, which was sufficiently dry, could not give passage to a current.

In Davy’s celebrated paper on “Some Chemical Agencies of Electricity,” read before the Royal

\* Becquerel, vol. iv.

Society 20th November 1806, the following experiments on the passage of acids, alkalies, and other substances, through various attracting chemical menstrea, are described :—“ An arrangement was  
“ made, consisting of three vessels: solution of sulphate of potash was placed in contact with the  
“ negatively electrified point; pure water was placed  
“ in contact with the positively electrified point,  
“ and a weak solution of ammonia was made the  
“ middle link of the conducting chain, so that no  
“ sulphuric acid could pass to the positive point in  
“ the distilled water without passing through the  
“ solution of ammonia: the three glasses were connected together by pieces of amianthus. A power  
“ of 150 pairs was used. In less than five  
“ minutes it was found, by means of litmus paper,  
“ that acid was collecting round the positive point:  
“ in half an hour the result was sufficiently distinct  
“ for accurate examination.

“ The water was sour to the taste, and precipitated solution of nitrate of barytes.

“ Similar experiments were made with solution of lime and weak solutions of potash and soda,  
“ and the results were analogous.”

It appears, therefore, that the constitution of the fluids of the body may be altered, certain principles may be withdrawn, and the ratio of the remaining principles may be changed. “In the same manner,” observes Mr. Donovan, “a new mode of entrance into the human body of active remedial agents is indicated more quick, more direct, more certain, than any other known, without the risk of being injured or altered by digestion, or of being eliminated by excretion.”

We may profit by these experiments, and thus by acupuncture apply our remedies directly to those parts we desire to act upon, when we find that the internal application proves inefficacious.

In the following diseases we endeavour to effect their cure by inducing electro-chemical decomposition in the part affected, founded on the knowledge of the chemical action of the two poles.

On passing a current through albumen, it coagulates round the positive pole, but none collects round the negative pole. This coagulation is due to the chemical action of the acids, which are separated at the positive pole by the action of the

current; at the negative pole, on the contrary, alkali is separated, which, as is well known, dissolves albumen.

*Rheumatic Effusion into the Joints.*

No part of the body is more frequently diseased than the membrane which secretes the synovia by which the joints are lubricated, and which forms a sack, having no external opening.

When a joint is distended with fluid, we generally find that there is also pain and inflammation, which cause an increase of the secretion from the surface of the synovial membrane. Cases do, however, occur in which a joint is distended from an increased quantity of fluid collected in its cavity unattended by pain or inflammation. It is presumed that this proceeds either from the diminished action of the absorbents, or from the increased action of the secreting vessels.

Inflammation of the synovial membranes is a constitutional affection when the system is under the influence of rheumatism. It is very often caused by cold, and attacks the knee more fre-

quently than any other joint, because it is the most exposed to the influence of the weather. The inflammation, when confined to a single joint, is generally more severe, and of longer duration, than when several are affected.

When the inflammation has subsided the fluid becomes absorbed, and in most cases the joint returns to its natural size and mobility, though in some stiffness and swelling remain. In this latter case the patient is very liable to a recurrence of the disease, either from exposure to cold, too much exercise, or derangement of the general health.

When the inflammation is connected with rheumatism, the same treatment as that employed in rheumatism will be found beneficial, especially the wine of colchicum.

In those chronic cases where there is considerable stiffness and swelling arising from some constitutional affection, it is first necessary to attend to the general health; to promote, by gentle exercise, a moderate degree of perspiration, which is extremely difficult, as the skin is usually dry and harsh; and to avoid raw fruit, acids, and whatever is likely to turn acid on the stomach, to which

there is a great tendency. The bowels should be regulated by warm aperients. These patients generally derive most benefit from a combination of the wine of colchicum, hydriodate of potash, and the bicarbonate of potash.

The application of the electric current to joints which are stiff and distended with fluid will succeed in rendering them supple, and its continued use will effect the absorption of the fluid. The current must only be used when stimulating applications are indicated, over which it has the great advantage of being often repeated without losing its influence on the part.

For further information I must refer the reader to my former work on Electro-Magnetism.

### *Opacity of the Cornea and Leucoma.*

Opacity of the cornea may result from adhesive inflammation and effusion of fibrine between its layers, or between it and the conjunctiva. Leucoma is produced by a loss of substance, and its resulting cicatrix.

The electric current should be applied in the



following manner:—A small ball of silver, connected with the negative pole of the battery, must be placed over the opacity, and a piece of silver connected with the positive pole must be placed on the tongue. The patient will experience a pricking, burning pain in the eye, the conjunctiva will redden, and some lachrymation be produced ; but these effects will quickly subside on applying cold water. If the opacity begins to break up under the application it will soon disappear. The current seems to act most beneficially in those cases where the effusion has taken place between the layers of the cornea, and has not become organized.

### *Paralysis of the Iris.*

I was consulted by a lady, who, in consequence of having dropped some solution of the sulphate of atropine into her eye, was suffering from dilatation of the pupil and impairment of vision, accompanied by a deep-seated pain in the ball of the eye.

This patient had consulted a medical man, who had employed various remedies unsuccessfully. When I saw her, the pupil was dilated to the margin

of the cornea, and was quite insensible ; the sight was much obscured ; there was considerable lachrymation, and she complained of pain in the ball of the eye. I determined to apply the electric current, and placed one pole on the eye, the other at the nape of the neck. The application removed the pain, and caused the pupil to contract slightly ; but it still remained motionless.

On the following day the eye was in the same state as when I last saw it. I again applied the current, and after fifteen minutes the pupil contracted to its natural size, and acted freely to the stimulus of light.

### *Cataract.*

Cataract implies an impairment or weakness of sight, produced by a partial or general opacity of the crystalline lens or its capsule.

Elderly persons are most subject to this disease, but it may occur at any age, and children are sometimes even born with it. Inflammation, or such injuries as give rise to inflammation, may produce cataract ; but it is also sometimes consequent upon an injury which is not attended

with any appearance of inflammation. In the aged it seems to proceed from defective nutrition.

I have mentioned the effect of the two poles on albumen, and the success frequently following the application in cases of opacity of the cornea; and I therefore would suggest a trial of the electro-galvanic current in such cases as cannot be relieved by any other known mode of treatment, before the doubtful issue of an operation is hazarded.

### *Ecchymosis.*

The black and blue discoloration following a bruise or contusion is caused by the escape of blood from the minute vessels into the cellular tissue, and is called an ecchymosis. A black eye affords an example. The treatment is regulated by the severity of the bruise; but when there is no inflammation we employ means to promote the absorption of the effused fluids.

The most satisfactory results generally follow the application of the electro-galvanic current, which acts as a powerful stimulant to the absorbents in quickening capillary action.

*Nævus.*

Nævi may be seated in the skin, or under it in the cellular tissue.

The superficial nævi, or mother-marks, frequently remain stationary during life ; but sometimes they have a disposition to grow after birth, and the skin over them being so exceedingly thin, profuse bleeding is very apt to occur from the slightest abrasion, which renders it expedient to remove them. The subcutaneous nævi may remain for a time stationary ; but their tendency is to enlarge and distend the skin, which at last bursts, and the patient's life may be endangered by hæmorrhage. In females this tendency is greatest at the menstrual periods.

There are several methods of treating this disease, but none of them, in spite of every precaution, are unattended with danger.

In consequence of some cases of fistula in ano and hæmorrhoids, reported in the *Lancet* of 1852 as having been successfully treated by platinum wires made red-hot by a galvanic battery, Mr. Hilton, of Guy's Hospital, determined to apply this

plan of cutting and searing at the same time upon a nævus of the flat kind, about the size of a crown piece, situate in front of the ear of a child two months old. The operation was performed with Cruickshank's battery, and a very thin wire, which it was at first intended to tie around half the tumour; but the wire ran so easily through it that the whole was completely removed, and the parts quickly cicatrized.

This was found to be a quicker method of removing nævi than the ligature, and just as secure, since hæmorrhage rarely followed.

"Heat," observes Mr. Smee, "is evolved when a certain amount of electricity is forced through a wire, which, from its small diameter, is incapable of conducting it quickly. This heat may be readily made to exceed that obtainable by any other process, except that of the oxyhydrogen blowpipe, as platinum may be made to run like wax by the electric force. The generation of a high temperature by electricity requires large batteries."

There can be no question but that the electric cautery will supersede every other application of intense heat to the human frame. Its manageable

character, by which the temperature may be raised to the nicest point, and its duration regulated to the smallest portion of time, gives it a very decided advantage over all other methods whatsoever.

The electro-thermal cautery may be of any magnitude, beginning with the finest platinum wire, and can therefore be applied to all parts, and used under all circumstances. For instance, to stop the bleeding of a tooth when other means have failed, a bent wire might be introduced into the cavity, and the cavity instantaneously destroyed by passing the galvanic current through the wire.

In using electric heat, it is necessary to guard against the fusion of the wires: this, however, may always be obviated by trying the experiment with the same length of wire prior to its application to the human body.

### *Stricture of the Urethra.*

In this complaint the electro-galvanic current is an efficacious remedy, and very little pain attends the application. After the urethra has been examined with a common plaster bougie, to

ascertain the exact position of the stricture, a metallic sound, covered with gum elastic, and having a conical silver point, should be very gently introduced into the anterior part of the stricture, and then connected with the negative pole of the electro-galvanic machine, the positive pole being placed in the hand or elsewhere. The application should be made daily, using each time a larger instrument, and allowing the current to flow from ten to twenty minutes, according to the feelings of the patient. Eight or ten applications have usually proved sufficient.

This mode of treatment will be found of essential service in old neglected cases, when the urethra for some extent has become converted into a thick gristly cartilaginous mass.

An Urethromenelyte, for the application of the current to the stricture, is made by Mr. Millikin.

### *Calculus in the Bladder.*

An Italian philosopher of celebrity, M. Orioli, proposed the application of the galvanic current for the solution of stone in the bladder, by means

of a sound, varnished everywhere, except at the point in communication, with a voltaic pile.

M. Bourges des Mortiere entirely dissolved a calculus out of the body, weighing one grain, in twenty-four hours, by galvanism.

MM. Prévost\* and Dumas submitted a fusible human calculus, placed in water, to the action of a hundred and twenty pairs of plates, during twelve hours. The weight in this period was diminished twelve grains. The experiment was renewed, and the current applied for sixteen hours, when the calculus was reduced to a mass so friable, that on the slightest pressure it separated into little crystalline grains which could easily pass through the urethra.

MM. Prévost and Dumas, in order to prove that the current did not injure the bladder, introduced a properly-prepared pair of conductors through the urethra of a dog, into the bladder, and connected them with a pile of a hundred and thirty-five pairs of plates, acted on by nitro-sulphuric acid. The dog was not discoverably incon-

\* Sur l'Emploi de la Pile dans le Traitement des Calculs de la Vessie. Par MM. Prévost et J. Dumas.



venieniced, while the bladder was distended with injections of lukewarm water.

A fusible calculus was then fixed to a sound, between the two platinum conductors, and the whole was introduced into the bladder of a large bitch; lukewarm water was injected, and the conductors were put in connexion with all the troughs which composed their battery. After some slight movements, the animal remained quiet, and endured the galvanic action for an hour. The calculus, when withdrawn, showed unequivocal traces of decomposition. The same process was repeated morning and night for six days; but the calculus had now become too friable to permit further repetition, and had lost weight in the same ratio as the former one. The animal, after a few days' repose, was killed, when it was found that the bladder was in its natural state.

The editors of the '*Annales de Chimie et de Physique*,' subjoin to this paper an observation, that nitrate of potash dissolved in water, injected into the bladder, renders the decomposition of hard, compact phosphates as easy as that of the porous kinds.

Dr. B. Jones read a paper at the Royal Society, on the Solution of Urinary Calculi by the aid of Electricity. This paper contained the record of a number of experiments made to determine whether out of the body urinary calculi could be dissolved, by placing them in dilute solutions of nitrate of potash, and then decomposing the solution in contact with the calculus by means of the galvanic battery. The different calculi which had been used were exhibited.

Dr. B. Jones arrived at the conclusion that uric acid calculi can be dissolved by the aid of electricity at the rate of from two to nine grains an hour. That phosphatic calculi can be dissolved at the rate of from two to twenty-five grains an hour. That calculi, consisting of oxalate of lime, proved to be far less soluble, and that they can be dissolved only at the rate of half a grain to two grains an hour.

At present, mechanical force is applied to the surface of the calculus, and the stone is passed in fragments; but by the aid of electricity, chemical force is set up at the surface of the stone, and it will be passed in solution or as an impalpable precipitate.

Every one must acknowledge the advantages of a method which will remove a calculus without pain or injury to the bladder, rendering an operation unnecessary, which is frequently followed by fever, inflammation of the bladder, or retention of urine, from the lodgment of a fragment of the stone in the urethra.

Mr. Millikin of the Strand has made an instrument for the application of the electric current to the stone, which he calls a Litholyte.

### *Chronic Glandular Tumours.*

These are met with in weak, scrofulous constitutions: they are at first perfectly indolent and painless, and may remain for years stationary or slowly enlarging. Their absorption should be promoted by external applications; and the general health at the same time must be improved by every possible means.

The poles of the electro-galvanic machine must be so applied that the electric current passes immediately over them, or when they prove intractable, medical agents should at the same time

be introduced by acupuncture, as before described.

### *Ulcers.*

An ulcer is a chasm formed on the surface of the body, by the removal of portions of the tissues back into the system, the absorbents appearing as if they took away the old particles more quickly than substitutes for them could be prepared, and deposited by the action of the discerning arteries.

There are many varieties of ulcers, each requiring different treatment; and the propriety of employing electricity must be left to the judgment of the medical attendant, who should bear in mind its electrolytic, thermal, and stimulating power, which may be applied in all cases where the healing process is imperfect.

Mr. Hinton applied electricity several times to old indolent ulcers, with varied success, but on the whole the results were satisfactory.

Dr. Willibrand always found electricity successful, except in those cases in which the general health was much impaired.

When, remarks Mr. Spencer Wells, an ulcer

presents an indolent or lardaceous base, this unhealthy base is destroyed, and the surface becomes a healthy granulating one after three days' application of the zinc plate. That after numerous trials of the methods of Baynton and Scott, of water and dry dressings, of elastic bandages, and various other accepted modes of treating ulcers, no means were found so capable of uniformly producing a rapid growth of healthy granulation as galvanism. That he has often been astonished at the change effected in twenty-four hours in the condition of ulcers. At one dressing they are seen to be deep, cup-like excavations ; at the next, the granulations have nearly reached the surface ; and after another day the surface has been level with the skin, the granulations uniform, and the well-known marginal blue rim, announcing the commencement of cicatrisation, has appeared. When this point is attained, it is better not to apply the apparatus again, but to employ simple water dressing.

During the few weeks he served in the Hibernia, a form of contagious circular sloughing ulcer was very prevalent. We used, he observes, to destroy

the diseased surface by undiluted nitric acid, and as soon as the slough separated, to apply the galvanic apparatus. The men often were allowed to walk about, and found no more impediment than from a simple bandage, and much trouble was spared in dressing. There is also a very obstinate form of ulcer which naval surgeons are often called upon to treat, produced by ropes being by accident forcibly and rapidly twisted round the limbs of sailors during some nautical manœuvre. A ring of skin, cellular tissue, fascia, and sometimes of muscle, is thus destroyed as by a burn ; and when this ring completely surrounds a limb, the slowness of the natural process of repair is quite remarkable under any variety of ordinary treatment. I had a case of this kind in the *Trafalgar*. The skin and other tissues, with some portion of muscle, were destroyed all round the calf of the leg, laying bare both tibia and fibula.

The slough separated, and an annular ulcer remained nearly two inches in breadth. The man was a long time on the sick list before I thought of employing galvanism, and scarcely any signs of a reparative process had appeared. I

then applied the silver plate of the apparatus to a portion of the ring, and it was quite extraordinary to trace the daily effects as the plate was moved around the large ulcerated surface, the spots where the metal had been applied for only twenty-four hours, being kept above the level of other parts, and consisting of small conical granulations in place of the beefsteak surface which had formerly existed. Cicatrisation afterwards took place as readily as in ordinary cases.

In cases where several ulcers exist upon a limb, and the zinc is applied to a superior, and the silver to an inferior one, or to denuded surfaces, all the ulcers situated in a direct line between the two plates improve in appearance, become healthy sores and cicatrise, while those on either side of the current remain unaltered and sometimes degenerate. In two cases in which I repeated this experiment, the result agreed with what I have just stated.

Dr. Crusell has healed in this manner primary syphilitic sores in three days.

*Cancer.*

The disease known by the name of cancer is divided, according to the consistence of the morbid growth, into hard and soft cancer.

It is often hereditary, and may occur in any part of the body, but most frequently attacks the womb, female breast, stomach, and liver.

Cancer is supposed sometimes to depend on some perversion of nutrition, in consequence of which, the lymph which exudes through the capillaries, forms an abnormal tissue with the properties of a malignant growth ; and sometimes to proceed from a blow or external injury, which however can only be regarded as an exciting cause, not capable of bringing on the disease unless there exists a constitutional tendency to its production.

In the commencement, the cancerous growth is usually indolent and painless, but as the disease advances it becomes affected with severe lancinating pain ; it may remain stationary for years, or increase slowly in size, but there are cases in which it spreads with frightful rapidity, eating away



adjacent parts ; the skin at length ulcerates, and a foul and repulsive sore breaks out which secretes an excoriating and particularly offensive discharge. Frequent hæmorrhages now take place, and the patient soon dies worn out by the pain and irritation of the disease.

It is more prevalent amongst females than males, seldom occurring before the age of thirty, and is most frequent between the ages of thirty-five and fifty, when the generative function ceases and the constitution undergoes the critical change. Women who bear no children are more frequently attacked than those who have families.

The nerve which goes to the part affected with cancer is in a state of extreme irritation, as is evident by the violent lancinating pain, and on examination it will be found to be thick and swollen. The nerve is not primarily but secondarily affected, for in the commencement, the disease is not attended with pain.

Professor Müller has discovered that the matter in all the varieties of cancer consists of very minute cells, that the original tumours enlarge and extend themselves by the development of new

cells, and that occurring in one part they are prone to appear in other parts.

With regard to the cells of animal bodies, one of the most wonderful and extraordinary results which I have observed is the action of electricity, derived from the intermittent current of the various forms of electro-magnetic machines. When a frog's foot is arranged in the field of the microscope, and the intermittent current is directed through the animal, the circulation instantly stops, as though by magic. The current in the veins, indeed, seems slightly to retrograde, though it still continues its course for a short period in the arteries; the whole effect giving the appearance of all the corpuscles having a tendency to be drawn into the capillaries.

In consequence of the corpuscles being drawn into the capillaries, an engorgement of them results. When, however, the current is withdrawn, the blood moves again more rapidly than before, and is instantaneously again stopped, when the current is renewed.

The action of the intermittent current is as decided upon the lymph-corpuscle, as it is upon the

common corpuscles ; for although, ordinarily, they run their course at a very different rate from the common corpuscles, they are stopped as suddenly by the intermittent currents. The interference with the circulation of the lymph-corpuscle in the capillaries is of more importance than that of the common corpuscle ; because, crawling along the side of the vessel, and apparently in contact with it, it is manifestly less acted upon by the *vis a tergo* of the heart's action.

When the continued current is employed, instead of the intermittent, the experiment is perhaps rather more difficult ; yet, if the current be passed completely through the body, precisely the same result occurs. I have seen the circulation absolutely stopped from the very feeble current of a dozen pairs of plates.

I need hardly state, that the bearing of these experiments is in the highest degree important, for it shows that, in whatever process of the body blood is necessary, there the electric force must have an influence. As it is manifest that the circulation of the blood affects more or less every operation of the body, I need hardly state that the

experiment demonstrates the importance of electricity as a therapeutic agent.\*

The application of a piece of metal to an open cancer, which is in connection with an electro-galvanic machine, will produce, after a certain time, a coagulated crust over the surface, and when this slough has separated there will be a healthy sore. The foetid smell, the constant severe pain, and the hardness will be greatly relieved. By this means scirrhus masses may be removed without loss of blood, owing to the coagulating power of the positive pole, and indeed it will be found a most efficacious remedy in hæmorrhage.

The electric current was employed at Guy's Hospital in a case of open scirrhus breast, in which there was a large, deep, irregularly-excavated sore, with hardened base, and often excessively tender. When the slough had separated, the negative plate was applied, and in some points cicatrisation commenced — the great tenderness was much relieved. It was difficult to apply it very effectually from the great irregularity of the

\* *Vide* Smee.

surface of the sore, yet the hardness at the base of the sore was materially lessened.

An electro-lytic institution has been founded at Moscow, under the direction of several medical men, who report to have cured sixteen cases of cancer, and to have removed the whole of a female breast without the use of the knife or the tying of an artery.

### *The Electric Moxa.*

The electric moxa is an excellent method of producing a persistent discharge, unattended by the pain which causes the issue or seton to be regarded by the patient with such extreme apprehension. A blister, the size of the intended issue, is placed on the required place ; when this is taken off, two small plates, the one of silver, the other of zinc, placed a few inches apart, and connected by a clean copper wire, are applied after removing the cuticle raised by the effused serum. They must then be covered with the common water dressing, and oil silk. In forty-eight hours the surface beneath the silver plate will be found to be healed, but beneath the zinc plate there will be

an eschar, which, when it has separated, will leave a healthy granulating sore freely discharging pus. The action of the electric moxa is thus explained : the saline ingredients of the fluid, effused on the surface of the blisters, are decomposed, the sodium of the common salt being set free at the silver plate becomes soda by oxydation, the chlorine evolved at the zinc plate forms chloride of zinc, which by its escharotic action produces the sore. The patient suffers none of that dreadful torture consequent on the use of caustic potash.

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